Association between temporomandibular disorder and body mass index in institutionalized children

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Abstract

Temporomandibular disorders (TMD) is a term applied to functional changes of the temporomandibular joint (TMJ) and associated structures of mastication. **Aim:** To investigate the correlation between body mass index (BMI) and TMD in children. **Methods:** 70 children between 6 and 14 years enrolled in the Rogationist Benevolent Institute of charity in the city of São Paulo (Brazil) underwent clinical examination by one calibrated examiner for the use of Research Diagnostic Criteria for TMD. Weight and height were determined by anthropometric assessment for the diagnosis of nutritional status, and BMI was calculated by dividing weight in kilograms by height in meters squared (kg/m^2). Descriptive analysis (mean and standard deviation) was used to characterize the sample. ANOVA complemented by the Least Significant Difference test was used to compare the mean anthropometric measurements between the genders and the groups with and without TMD. The significance level was set at 0.05. **Results:** We found a significantly high prevalence of TMD, as well as a significant association between TMD light and low body weight. **Conclusions:** The results show a high prevalence of TMD and a slight association between TMD and children with low body weight.

Keywords: temporomandibular disorders, stomatognathic system, body mass index, orofacial structures, masticatory muscles.

Introduction

Temporomandibular disorders (TMD) is a blanket term applied to functional abnormalities of the temporomandibular joint (TMJ) and associated masticatory structures[1]. The main signs of TMD are joint noises and limited range of motion or deviation during mandible function, while the main symptom is pain in the pre-auricular region, TMJ and/or masticatory muscles[2-4]. TMD has a multi-factor etiology, including occlusal disharmony, parafunctional oral habits and posture imbalance as well as psychosocial and behavioral alterations[5].

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Mastication is the action of biting, shredding and pasteurizing food. It is considered the most important function of the stomatognathic system, as it is the initial phase of the digestive process, in which foods are mechanically broken down to an adequate size for swallowing. The force, movements, duration and type of mastication are influenced by morphology, health status of orofacial structures, functional capacity of muscles and joints and characteristics of the food. A number of studies on the association between the prevalence/severity of TMD in children and types of food ingested have demonstrated a significant impact of TMD on the quality of life of affected individuals when compared to those with no complaints of pain. Functional problems, such as difficulty chewing certain foods, are reported to be fourfold higher among patients with TMD[6-11]. However, no studies were found in the literature correlating TMD with nutritional status in children.

Monitoring nutritional status is important in all age groups and it is at the core of healthcare actions directed at childhood and adolescence. The importance of nutritional status in these phases of life is related to the growth and development process. Poor nutrition can lead to early health problems and the risk of disease, especially considering the growing prevalence of overweight/obesity in the world[12-15.]

The World Health Organization recommends assessing the nutritional state of children using weight/height and height/age indicators[16]. In recent decades, different criteria for this assessment have emerged and the body mass index (BMI) had been proposed as an indicator of nutritional status[17-21]. The BMI is used to identify possible weight problems. The Centers for Disease Control and Prevention and American Academy of Pediatrics recommend the use of the BMI to determine overweight beginning at two years of age. However, it is not a diagnostic tool. For example, the BMI may indicate whether a child is overweight; however, in order to determine whether the excess body fat is a problem, the physician needs to perform tests such as the measurement of skinfolds and carry out assessments of diet, degree of physical activity, family history, etc.[22].

In children, along with the weight variation, the BMI also changes with height and age and its direct application is therefore unsatisfactory. The calculation of BMI percentile is based on weight and height percentile tables and is more adequate for use on children. Another simple method is the use of graphs that correlate weight and height by age and provide a clear, immediate visualization of the magnitude of the disproportion between weight and height. If the height of a child is between the 50th and 75th percentiles, ideal weight is located between these same percentiles. Using a curve, the estimate of the amount of weight that should be lost (when the degree of excess weight is considerably large) can be determined or the amount of time in which the current weight should be maintained until it is adequate for the height (when the excess weight is not accentuated) can be estimated. The BMI percentile actually only numerically expresses the extent to which a child's weight deviates from normal values on the weight versus height-for-age curve[23].

Considering the close relationship eating habits have with BMI and the development of TMD, the aim of the present study was to investigate the association between BMI and TMD in Brazilian children.

Material and methods

A cross-sectional study was carried out for the assessment of the association between the body mass index and temporomandibular disorder among 70 children between 6 and 14 years of age enrolled at the Rogationist Benevolent Institute of charity in the city of São Paulo (Brazil). The following were the inclusion criteria: age between 6 and 14 years; presence of primary 2nd molar and permanent 1st molar among children from 6 to 10 years of age; and presence of permanent 1st molar among children from 11 to 14 years of age. The following were the exclusion criteria: current medical, psychological or dental treatment; and dental/facial deformities. All individuals had the same eating pattern – 4 daily meals under the supervision of a nutritionist on staff at the institution. The study was carried out in compliance with the norms that regulate studies involving human subjects in Resolutions 196/96 and 251/97 of the Brazilian National Health Council and received approval under process nº 249781. The parents/guardians of the children signed informed consent forms. All participants responded to a screening questionnaire for orofacial pain and temporomandibular disorder recommended by the American Academy of Orofacial Pain, made up of 10 self-explanatory questions with yes/no answers on the most common signs and symptoms of TMD[2].

The participants were submitted to a clinical exam by single examiner calibrated for use of the Research Diagnostic Criteria for TMD[2] (Axis I)[2]. The exam constituted an extraoral and intraoral inspection of the teeth and occlusion, palpation of the trapezium, sternocleidomastoid, temporal, masseter, digastric and medial pterygoid muscles, palpation of the TMJs, determination of joint noises and analysis of mandible movement using a digital pachymeter (Mytutoio®) for the measurement of maximal mouth opening and lateral movement. Information on frequent headaches, facial pain, facial muscle fatigue, difficulty chewing, teeth grinding, psychological aspects, non-nutritive sucking habits and nail biting was also collected.

Weight and height were determined for the anthropometric evaluation. Weight was determined on a digital scale (Filizola) with a capacity of 150 kg and a precision of 100 g, with the individual barefoot and wearing shorts and a t-shirt. Height was determined with the individual barefoot, standing erect against a flat vertical surface, arms down, palms of the hands on the thighs, heels together and feet apart, knees in contact and head adjusted to the Frankfurt plane. The measurement was taken using a stadiometer with a capacity of two meters and precision of 0.1 cm.

For the diagnosis of nutritional state, the body mass index (BMI) was calculated dividing weight in kilograms by height in meters squared (kg/m2). The children were classified

considering BMI values according to gender and age using the percentile distribution proposed by Must *et al.*[13], which was designed for the classification of adults and children beginning at 6 years of age according to gender, age and race[23]. The calculated BMI was then plotted on the BMI diagram for age and gender in order to determine the percentile classification.

The data were organized in tables and graphs and submitted to statistical tests. Descriptive analysis (mean and standard deviation) was used for the characterization of the sample. ANOVA complemented by the Least Significant Difference test, was used to compare the mean anthropometric measurements between genders and groups with and without TMD. The level of significance was set at 0.05.

Results

Among the 70 children evaluated, 39 (54.92%) were female and 31 (45.07%) were male; mean age was 9.67 years (standard deviation = 2.152); 50 (71.4%) exhibited some degree of TMD, 27 (54%) of whom were female. There was no significant association between gender and TMD (p=0.648). Among the individuals with TMD, 29 (58%) had mild TMD, 16 (32%) had moderate TMD and 5 (10%) had severe TMD.

Table 1 displays the mean and standard deviation values for BMI in relation to age and the percentile classification of the age category. Thirty-five children (50.0%) had a healthy weight; 9 (12.9%) were at risk of overweight; 22 (31.4%) were underweight; and 4 (5.7%) were overweight.

Table 2 displays the distribution of individuals according to age and presence/absence of TMD. There was a statistically significant association (p < 0.05) between the presence of TMD and age among the participants between eight and 10 years of age.

The distribution of individuals according to degree of TMD and BMI per percentile reveals that, among the 50 children with TMD, 4 (8%) were underweight, 40 (80%) had a healthy weight, 5 (10%) were at risk of overweight; and 1 (2%) was overweight. Among the 20 children without TMD, one (5%) was underweight, 12 (60%) had a healthy weight, four (20%) were at risk of overweight and 3 (15%) were overweight. Analyzing the degree of TMD in relation to BMI per percentile, there was a statistically significant association

Table 2. Number and percentage of participants with and without TMD according to age

Age	Without TMDN (%)	With TMDN(%)	TOTAL
6 years	1 (20%)	4 (80%)	5 (100%)
7 years	2 (25%)	6 (74%)	8 (100%)
8 years	2 (16.7%)*	10 (83.3%)*	12 (100%)
9 years	0	6 (100%)	6 (100%)
10 years	5 (35.7%)*	9 (64.3%)*	14(100%)
11 years	4 (50%)	4 (50%)	8 (100%)
12 years	3 (37.5%)	5 (62.5%)	8 (100%)
13 years	3 (33.3%)	6 (66.7%)	9 (100%)
TOTAL	20 (28.6%)	50 (71.4%)	70 (100%)

* Statistically significant association; p<0.05

(p < 0.05) between underweight children and mild TMD (Table 3).

Discussion

The present study found a high prevalence of TMD among institutionalized children as well as a significant association between mild TMD and low body weight. These data corroborate the theory that TMD has a multifactor origin caused by the association of psychological, structural and postural factors that disharmonize the functional balance between the three fundamental elements of the stomatognathic system: dental occlusion, masticatory muscles and TMJ[1-6,14,17,21,24,25]

The etiological factors of TMD in children are similar to those in adults. It is widely accepted that there are predisposing, initiating and perpetuating factors. Predisposing factors increase the risk of TMD and are divided into systemic, psychological and structural. Initiating factors cause the onset of TMD. Perpetuating factors affect the progression and cure of this condition[14-24]. The multifactor etiology of TMD in young populations involves parafunctional habits, trauma and occlusal, systemic and psychological factors.

The prevalence of TMD in children varies considerably with patient age and the criteria used during the examination. Comparing different studies on the prevalence of TMD in children, Pahkala and Laine (1991)[24] found a prevalence of signs and symptoms of TMD of 40% among 5-to-8-year-olds, 46% among 9-to-12-year-olds and 31% among 13-to-

Table 1. Mean BMI and weight classification according to age

	N(%)	Mean BMI(standarddeviation)	Underweight	Healthy weight	Risk of overweight	Overweight
6 years	5 (7.1%)	16.81 (2.08)	3 (60%)	2 (40%)	0	0
7 years	8 (11.4%)	16.36 (2.26)	6 (75%)	1 (12,5%)	0	1 (12.5%)
8 years	12 (17.1%)	17.04 (1.62)	10 (83.3%)	1 (8.3%)	0	1 (8.3%)
9 years	6 (8.6%)	17.69 (2.82)	0	6 (100%)	0	0
10 years	14 (20.0%)	18.73 (3.97)	0	11 (78.6%)	2 (14.3%)	1 (7.1%)
11 years	8 (11.4%)	20.17 (3.18)	2 (25%)	4 (50%)	1 (12.5%)	1 (12.5%)
12 years	8 (11.4%)	20.83 (2.45)	0	5 (62.5%)	3 (37.50%)	0%)
13 years	9 (12.9%)	16.81 (2.08)	1 (11,1)	5 (55.6%)	3 (33.3%)	0

Table 3. Distribution of individuals according to the severity of TMD and BMI per percentile

	Underweight		Healthy weight		Risk of overweight		Overweight		Total	
	n	%	n	%	N	%	n	%	n	%
Without TMD	1	5.0	12	60.0	4	20.0	3	15.0	20	100.0
Mild TMD	21*	72.4	4	13.8	4	13.8	0	0	29	100.0
Moderate TMD	0	0	14	87.5	1	6.3	1	6.3	16	100.0
Severe TMD	0	0	5	100.0	0	0	0	0	5	100.0

* Statistically significant association; $p < 0.05$

15-year-olds; the authors report that the signs and symptoms of TMD in children range from mild to moderate and may even be unconscious, thereby reflecting physiological and psychological changes, rather than a pathology[24]. There was no association between an increase in age and the presence of TMD in the present study, but previous studies have reported such an association.

A stronger association between age and the presence of TMD was found among the participants between eight and 10 years of age. According to Bertoli et al.[25] (2009), during the transition from the primary to the permanent dentition and the growth and development of the craniofacial complex, children may exhibit disorders, as a series of adaptive changes in the TMJ occurs in this period[25].

Mastication is one of the most important functions of the stomatognathic system and is influenced by a number of general and local factors. General factors include changes in eating habits influenced by culture as well as the socioeconomic and psychological profiles of the population. Local factors that affect mastication include occlusal equilibrium, the presence/absence of teeth, dental health and status of the TMJ. Besides directly influencing the function of the stomatognathic system, eating habits have been associated to nutritional status, as measured by the BMI[26-28]. The present investigation is the first study to demonstrate an association between mild TMD and low body weight in children, which may indicate that eating habits not only influence the BMI, but may also contribute toward the development of TMD.

The children analyzed in the present study had the same eating pattern, as they were all offered the same types of food. Thus, it may be inferred that the variations in BMI per percentile are associated to the amount rather than the quality of the food ingested.

Murray et al.[29] (1996) analyzed 121 adults in order to determine whether there is an association between TMD, BMI, eating habits and quality of life. The authors found that the BMI among individuals with TMD deviated from normal values toward both overweight and underweight and such individuals exhibited orofacial pain, psychological disorders and a lower quality of life. Individuals with mild to moderate TMD had a lower BMI than those without TMD. The present study corroborates these findings and lends support to the statement by Murray et al.[29] (1996) that one of the explanations for this association is that the difficulty in chewing foods may be governed by the characteristic pain during mastication in cases

of TMD[29]. It should be stressed that many of the individuals analyzed in the present study were in the mixed dentition phase, which is a transition stage of the occlusion.

As TMD has a multifactor etiology and may be the result and/or cause of psychological and eating alterations, multidisciplinary treatment involving a physician, dentist, nutritionist, psychologist and physical therapist is needed while the patient is still in childhood. Moreover, the signs and symptoms of TMD tend to exacerbate with age[28]. Therefore, preventive and therapeutic measures need to be initiated early. Further studies need to be carried out for a detailed assessment of other aspects involved in the physiopathology of TMD and its correlation with nutritional status and psychological state.

In conclusion, the results of the present study reveal a high prevalence of TMD and an association between mild TMD and children with low body weight.

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